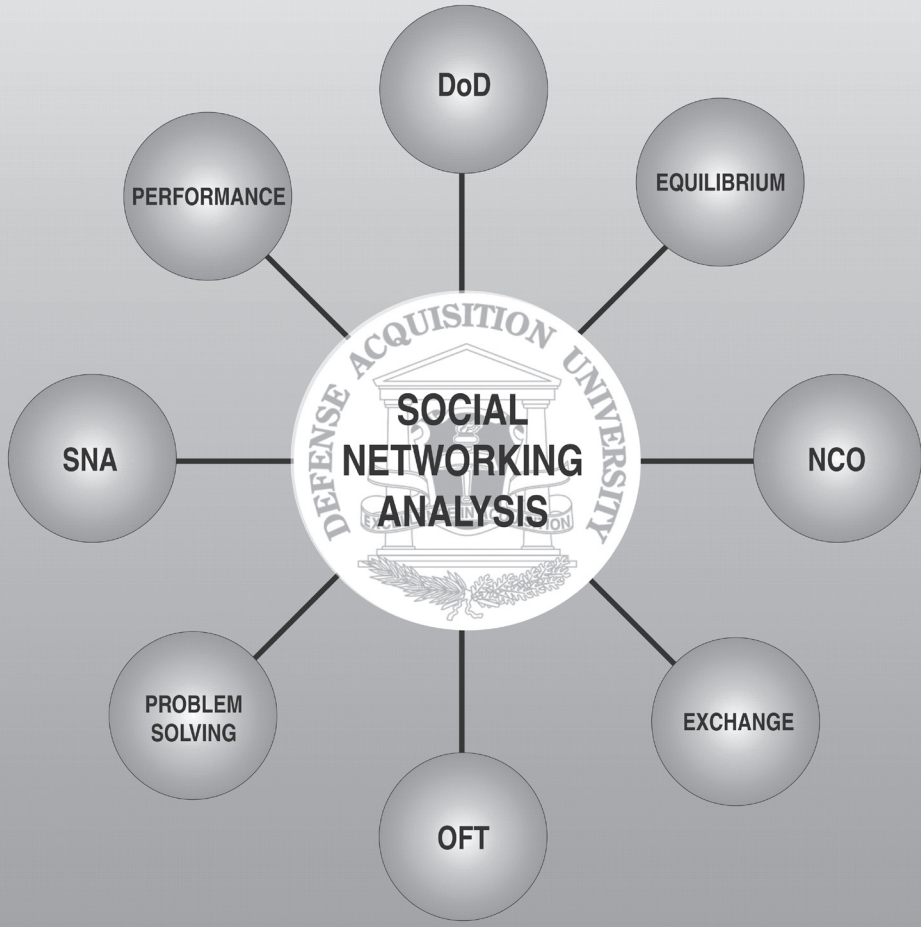
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SOCIAL NETWORKING ANALYSIS: *ONE OF THE FIRST STEPS IN NET-CENTRIC OPERATIONS*

Tom Edison

Improving net-centric operations (NCO) implementation and transformation initiatives are key focus areas across the Department of Defense (DoD). More specifically, the Defense Acquisition University (DAU) assisted the Office of the Secretary of Defense, Office of Force Transformation (OFT) in its efforts to create opportunities to align with academic institutions and accomplish research on specific NCO topics. For example, a three-day class was conducted at DAU on the key processes and concepts involved in implementing NCO. One key concept presented in the class was social networking analysis (SNA). This article will review some of the concepts and theories of SNA, the history of research in the field, and how this management tool can enhance DoD transformation to a net-centric operation.

The study of management has transformed significantly over the last 30 years. Aiding in this transformation has been the introduction of theories and concepts from varied fields of study, including organizational behavior and economics, as well as the fields of biology, sociology, and anthropology. The field of biology in particular has enabled the study of management to better understand and theorize about the interrelations, connections, and networks that occur in and between organizations. It also helped introduce a systems or network approach to management that forms the basis for a greater understanding of the effects of technology, diversity, structure, and strategy on organizational performance and for Department of Defense (DoD) troop and leader effectiveness in the combat environment (Perez & Kedia, 2002).

How has *management thinking* been transformed over the last 30 years, and how can this knowledge of transformation aid in our understanding of general management

theories and innovations in the DoD? Let us first look at some of the early history of the development of management into a more exact discipline. Its relationship to another expanding field of study, social network analysis (SNA), is important to aid the reader in understanding some of the current trends in the field of management. Many of the concepts and ideas developed in this paper came from the work done by Liliana M. Perez and Ben L. Kedia (2002).

It is important to understand how network analysis came to form part of current management thought and is transforming the ways of thinking about social relationships in management and leadership in government and commercial organizations.

NETWORK ANALYSIS

Social network analysis, used throughout sociology, has surfaced as a method that helps explain interrelationships between actors (i.e., individuals, groups, team members, organizations, and countries) (Perez & Kedia, 2002). It is important to understand how network analysis became incorporated into current management thought and how it is transforming management's way of thinking about social relationships and leadership in government and commercial organizations. This paper will highlight how network analysis has become relevant to management studies, how it is transforming how we study social relationships, how it can be used to understand how actors interact (especially under stress or chaos), how it can be used to understand behavior, what are effective member characteristics to improve networking, how all of these elements affect performance, and how performance can be better analyzed and interpreted using network analysis.

Valente (1995) explained that a "network is the pattern of friendship, advice, communication, or support that exists among members of a social system" (p. 31). A *social network* is a series of choices by actors that are either positive (creating a contact) or negative (not creating a contact). They are based on some criterion (e.g., liking/necessity or disliking/non-necessity) (Moreno & Jennings, 1938; Moreno, 1941; Hommans, 1986). An *actor's network* is the social structure in which he or she is embedded. In other words, it refers to all the relationships or ties between actors. These ties can be strong or weak (Granovetter, 1973), depending on how close the relationship is between the actors.

Social network analysis is a methodology used to analyze the relationships, ties, and communication occurring between actors by determining who has relationships with whom (Valente, 1995). The SNA involves the study of the choices made by actors in a social environment. A more refined use of network analysis is defined by other authors as organizational network analysis and has been used more recently in works by policy and political experts when discussing the networks used by terrorist groups (Arguilla & Ronfeldt, 2001). There are different uses of the application of network analysis. The next section will highlight the theory and application of SNA in comparison to organizational network analysis. Organizational network analysis infers focusing on the network more as an organizational structure and less on its social interactions and connections. This paper is concerned about both aspects, social and organizational, in the explanation of network analysis. This distinction is introduced here to help the reader understand there is a difference in these two concepts.

ORGANIZATIONAL NETWORK ANALYSIS

The actors in SNA consist of individuals or other groups in the organization, such as teams, departments, divisions, companies, and industries when forming networks of contacts. These contacts can be formal alliances, cooperatives, interlocking directorates, intergovernmental relationships, supplier/customer relationships, and joint ventures or they can be more informal, from chance meetings or relationships based on mutual goals that are not legally binding. Usually they occur for some common benefit, like a transfer of knowledge, power, economies of scale, access to new markets, legal conformance, and/or institutional legitimacy in order to understand the social structure of the competitive arena (Perez & Kedia, 2002). The "network structure is not used to predict attitudes or behaviors directly. It is used to predict similarity between attitudes and behaviors" (Burt, 1992, p. 11). Moreover, "network analysis can be used to understand the flow of personal influence by enabling researchers to define what influences whom in a social system" (Valente, 1995, p. 2).

Kedia and Perez (2000) highlighted that network analysis can be done through focusing on four different elements of networks: the *characteristics* of the network (i.e., characteristics with respect to the form versus the relationships), the types of *actors* in the network (i.e., central versus peripheral positions and active versus passive roles), the *scope* of the network (i.e., international versus domestic networks), and the type of *diffusion* network (e.g., structural equivalence versus cohesive ways to diffuse information in the network). Network analysis can help focus on the types of actors in the network and the power of SNA can be used to understand and interpret how individuals and/or teams can affect the ability of other teams to perform. Social networking can transform how we study and understand team member dynamics. In general, it can be a powerful tool in DoD for understanding human interactions and network interactions, especially when confronting the *fog of war*.

EARLY APPLICATIONS

Network theory was probably first introduced in the field of electrical and electronic engineering (Murdock, 1927). However, network analysis was first introduced in the social sciences through the work of anthropologist Alfred Reginald Radcliffe-Brown (1881–1955). He introduced his concept of social structure that discussed the metaphors of the *fabric* and *web* of social life (Scott, 1949).

These textile metaphors aided in the understanding of the structure of relations through which social actions were organized and SNA came to be (Scott, 1949). Network images were initiated in sociology through the pivotal studies in sociometry of the Austrian psychoanalyst Jacob L. Moreno in 1932 and 1934 (Freeman, 2000). Network analysis as we know it today was first formulated in the work of Moreno and H. H. Jennings (Moreno & Jennings, 1938; Moreno, 1941). They suggested that there are structural processes observed in groups that are best understood by networks. They highlighted that after an actor develops a connection with one person, these actors also have the ability then to link with other actors who also form a like ability for interpersonal selection and linkage. Moreno and Jennings (1938) highlighted that this is considered growth in structures since these linkage abilities develop over time and help the network expand. These authors also focused on the fact that an actor can develop several social aggregates that occur from varying criteria. In addition, actors are attracted to some individuals, but not to others, creating the foundation for networks that do not overlap each other and isolate those who are not selected for linkage in the network being created (Perez & Kedia, 2002).

Moreno (1941) also introduced some characteristics of networks. He discussed networks as being psycho-social networks, and that network sizes varied. They could be limited to a specific location or throughout different communities. He also explained the reasons why actors are linked to certain others and not everyone. He explained that these characteristics could explain why organizations or units grew or decayed. Moreno (1938) also identified actors in the network as to their specific role or function. Individuals could either be active or passive. His work represented the first attempt to understand characteristics of actors and networks that affected their nature or ability to perform, and introduced the concept that networks could be analyzed, its members or actors surveyed and understood, and the overall performance of the network interpreted in relationship to the individual analysis of the members or actors of the network.

Moreno and Jennings (1938) introduced the theory of networks, they did not, however, expand its capacity to study relationships in management (Perez & Kedia, 2002). This was done through the works of others in sociology and anthropology, which is reviewed below.

SOCIOLOGY AND ANTHROPOLOGY

In sociology, Boissevain (1968) proposed a distinction between the intimate, effective, and extended zones of the network. The intimate zone is composed of those people who are on closest terms with the anchor actor. The effective zone consists of those people

whom the anchor individual is on less intimate terms and from whom they can expect less than the members of the more intimate network. The extended zone are those people who the anchor individual does not know at all but could contact if needed. In sociology, Granovetter (1973) explored the strength of ties in job hunting. He analyzed both weak ties (acquaintances) and strong ties (family and friends) and found that weak ties are a vital component of the overall social structure because they link otherwise disconnected social clusters into a broader network of connected actors.

In anthropology, Barnes (1969) introduced the distinction between stars and zones. Stars are links beginning at any selected person in a network with others in that network. The direct links constitute a first order star. The indirect link is to a person through others called the second, third, or higher order star. Zones are the stars together with the links among the persons in a star of any order (Perez & Kedia, 2002). Barnes interpreted the links and how they affected the actors in the network in terms of influence and information.

In sociology, Boissevain (1968) proposed distinctions between the intimate, effective, and extended network zones.

Mitchell (1974) discussed the social network literature in anthropology and sociology and helped explain the different ideas they introduced. He highlighted that there was still a debate as to whether network theory was an approach, or way of thinking, rather than a theory. Mitchell (1974) states that most authors who use social networking to analyze data do not create a formal network theory. He stated that in his way of thinking "there is no network theory in the sense of basic assumptions together with a set of derived propositions which are interlinked and capable of being tested" (p. 238). He does emphasize, however, that according to these criteria there are few theories in social anthropology.

The study of the diffusion of information in networks was significant in network analysis. Burt (1983, 1987), in his early work, studied different network models of diffusion. He discussed that social contagion occurs when people use one another in a network to manage the uncertainty of innovation. This social contagion includes an individual who has not adopted an innovation, called the ego, and an individual who has already adopted it, called the alter (Burt, 1987). The cohesion model focused on the socialization between ego and alter. The more effective the communication is between alter and ego, the more that the alter's adoption of the innovation will trigger the ego's adoption of it. The structural equivalence model involves the competition between

alter and ego. "The competition of people merely using one another to evaluate their relative adequacy" (Burt, 1987, p. 1,291). Structurally equivalent people have the same position in the network and they have identical relations with all other individuals in the network.

Burt (1992) created the structural hole and added to the type of tie that could occur in a network. Structural holes are "the separation between non-redundant contacts" (Burt, 1992, p. 18). Because two non-redundant actors are connected by a structural hole and are not directly linked, they both benefit the network more than if they were connected; they provide benefits that are more additive than overlapping.

The more effective the communication is between alter and ego, the more that the alter's adoption of the innovation will trigger the ego's adoption of it.

Major characteristics about social networks and ancestors in the social networks are related to the concept of centrality (Friedkin & Slater, 1994). Centrality relates to an actor and the position they have in the network. Friedkin and Slater (1994) focused on the interpersonal effects of an actor in a network and highlighted that for the most part the centrality of the individual determines their influence as an actor in the network.

Network analysis was first conceived by Jacob L. Moreno (1938, 1941) in his work on sociometry. However, the entire conceptualization of network analysis has been a product of years of work from anthropologists and sociologists.

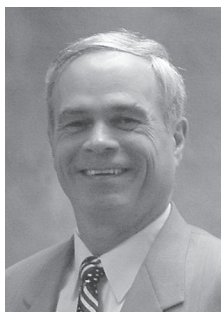
CONCLUSIONS

This article highlights some recent transformations that are occurring in the field of general management theory. Network analysis, with its connection to biology, sociology, and anthropology, has been linked through its study of networks (and how people communicate and socialize) to management theory. To determine how and why some government organizations outperform others, there is a need to study "the entire elephant." Research should not necessarily be based on a single management theory. Researchers need to transform how and where they study. They need to study different fields to determine how humans interact or link to other humans. We need to alter our thinking to include network analysis.

The field of network analysis has helped to transform the study of management theory. Network analysis can be, and in many cases has been, used to provide a more integrated approach to management that has enabled managers and researchers to obtain

a greater understanding of and appreciation for the effects of various attributes (like technology, diversity, structure, and strategy) on performance. Network analysis can be a powerful and profound tool in the right management theorist or practitioner's toolkit. It can also be a meaningful technique to aide in the transformation of management thinking within the DoD and help introduce the concept of networking and net-centric operations into general management thinking and research. In fact, social network analysis is one of the main concepts used by the Office of Force Transformation (OFT) to study the dynamics and personal interactions occurring in the battlefield. The goal is a universal understanding of its theories and its potential use in war and peacetime operations.

The OFT has introduced social network to its list of tools that can be used to help explain the forces and influences that determine how decisions and choices are made—especially during periods of crisis and facing the *fog of war*. The impact or study of networks has thus expanded from the common use of networks to explain the influence of the electronic networks on management and decision making to include the social network. The information in this paper helps to explore the field of social network analysis, which is believed to be the first step we can take to become more NCO-oriented, helping to transform how we conduct business in DoD. The SNA helps to understand how people network and how this affects the way we operate and function.



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